

PATENT ABSTRACTS OF JAPAN

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(71)Applicant : RICOH CO LTD

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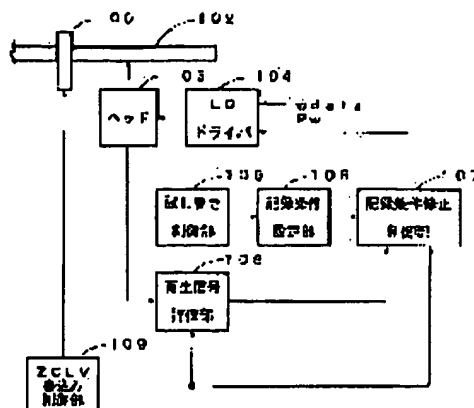
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(54) INFORMATION RECORDER

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain the optimum recording condition with respect to a linear velocity while making the best use of the special feature of ZCLV.

SOLUTION: The device is furnished with a ZCLV writing control part 109 for arranging a plurality of recording zones in the radial direction of an optical disk 102 to perform the write-in with specified linear velocities different for every zone, a reproduced signal evaluating part 108 for evaluating the reproduced signal by reproducing the already recorded part on the preceding zone when the recording zone is changed over or the already recorded part on a new zone, and a recording condition correcting part 107 for correcting the recording condition of the new zone in accordance with the evaluation result obtained by a reproduced signal evaluating part 108, then, the recording condition of the new zone is corrected in accordance with the evaluation result of the reproduced signal evaluating part 108.



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Dictionary: Last updated 08/25/2006 / Priority: 1. Information communication technology (ICT) / 2. Electronic engineering / 3. Industrial Products

CLAIMS

[Claim(s)]

[Claim 1] the circumferencial direction of a disk-like record medium -- abbreviation -- [fixed linear density / it is Information Storage Division equipment which writes in information, and] When changing said record zone to the zone CLV writing control means which writes in with a predetermined linear velocity which establishes two or more record zones in the radial direction of said record medium, and is different for every zone, Information Storage Division equipment characterized by having a regenerative-signal evaluation means to reproduce the recorded portion in the last zone and to evaluate a regenerative signal, and a recording condition correction means to amend the recording condition of a new zone based on the evaluation result by said regenerative-signal evaluation means.

[Claim 2] A trial writing means to perform trial writing to the predetermined field of said record medium at a predetermined basal line speed, and to determine the optimal recording condition at said basal line speed as it, and when recording on said record medium with a different linear velocity from said basal line speed, Have a recording condition setting means to set up a recording condition according to the result of having performed the predetermined operation to the optimal recording condition at said basal line speed, and [said recording condition correction means] Information Storage Division equipment according to claim 1 characterized by amending the recording condition of the new zone which said recording condition setting means set up based on the evaluation result of said regenerative-signal evaluation means.

[Claim 3] the circumferencial direction of a disk-like record medium -- abbreviation -- [fixed linear density / it is Information Storage Division equipment which writes in information, and] The zone CLV writing control means which writes in with a predetermined linear velocity which establishes two or more record zones in the radial direction of said record medium, and is different for every zone, Information Storage Division equipment characterized by having a regenerative-signal evaluation means to reproduce the recorded portion in a new zone and to

evaluate a regenerative signal, and a recording condition correction means to amend the recording condition of a new zone based on the evaluation result by said regenerative-signal evaluation means after changing said record zone.

[Claim 4] A trial writing means to perform trial writing to the predetermined field of said record medium at a predetermined basal line speed, and to determine the optimal recording condition at said basal line speed as it, and when recording on said record medium with a different linear velocity from said basal line speed, Have a recording condition setting means to set up a recording condition according to the result of having performed the predetermined operation to the optimal recording condition at said basal line speed, and [said recording condition correction means] Information Storage Division equipment according to claim 3 characterized by amending the recording condition of the new zone which said recording condition setting means set up based on the evaluation result of said regenerative-signal evaluation means.

[Claim 5] A recorded state storage means to memorize the value according to the regenerative signal from said record medium when beginning record to said record medium as recorded state desired value based on the recording condition which said recording condition correction means amended, Information Storage Division equipment given in any 1 clause of Claim 1 characterized by having a record power correction means to compare said recorded state desired value with the value according to the regenerative signal from said record medium, and to correct record power according to the comparison result concerned while recording information on said record medium to 4.

[Claim 6] Said regenerative-signal evaluation means interrupts record, whenever predetermined conditions are satisfied, and it reproduces a discontinuation preceding-record finishing portion, evaluate it, and a regenerative signal [said recording condition correction means] Information Storage Division equipment given in any 1 clause of Claim 1 characterized by amending a recording condition based on the evaluation result of said regenerative-signal evaluation means, and resuming record to 5.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention is used for the record medium of linear-density regularity, for example, the record power control of CD-R (Compact Disc Recordable), and relates to suitable Information Storage Division equipment.

[0002]

[Description of the Prior Art] A CD-R disk is in the record medium of linear-density regularity. Usually by such a disk, it records, making it rotate by linear-velocity regularity (CLV:Constant Linear Velocity). In this case, since the relative velocity of a record medium and a laser beam

is always constant, once it decides the optimal, it is not necessary to change recording conditions, such as record power and recording pulse width, over the whole surface. For this reason, it is usually the specific field of the disk most-inner-circumference section, and using the optimum recording power which shook power, and performed trial writing, then was determined, it records completely with the same linear velocity, and is satisfactory.

[0003] However, since it is necessary to make a rotational frequency high in CLV as the disk inner circumference section, it becomes difficult to make it rotate, if it becomes high-speed. Therefore, motor cost becomes high, and noise and vibration increase and the design of a servo system also becomes difficult. Then, the technique of seldom lowering a rotational frequency to instead of [which seldom raises a rotational frequency by inner circumference] as a perimeter wall is taken. In this case, linear velocity becomes so high that it goes to the perimeter. For this reason, the technique of the zone CLV (ZCLV is called hereafter) which divides a zone in a suitable radius position, sets the inside of that zone to CLV, and is made into such high linear velocity that it goes to a perimeter zone is taken.

[0004]

[Problem to be solved by the invention] By the way, in the above-mentioned ZCLV, the case recorded with a different linear velocity from the linear velocity of the inner circumference field which carries out trial writing comes out. In this case, it becomes a technical problem how the recording condition of those power and others is set up.

[0005] Then, the equipment which gives a predetermined operation to a trial writing result and computes the recording condition of different linear velocity was developed conventionally. However, according to this equipment, when the relation of the recording condition over linear velocity has differed from the predetermined operation relation with the film property variation of a record medium, the variation by a radius, the variation of a recording device, etc., it may not become the optimal recording condition. Moreover, although the equipment which interrupts record suitably during record, reproduces a recorded portion, amends a recording condition, and resumes record was also developed, the present condition was having come to optimize the recording condition in a new zone at the time of the zone change of ZCLV.

[0006] [maintaining the feature which can be written in high-speed, though this invention is made in view of the above-mentioned situation and it is the low rotation of ZCLV] Even when the relation of the recording condition over linear velocity has differed from the predetermined operation relation with the variation by the film property variation and the radius of a record medium, the variation of a recording device, etc., it aims at offering the Information Storage Division equipment which can acquire the optimal recording condition.

[0007]

[Means for solving problem] invention according to claim 1 -- the circumferential direction of a disk-like record medium -- abbreviation -- [fixed linear density / it is Information Storage

Division equipment which writes in information, and] When changing said record zone to the zone CLV writing control means which writes in with a predetermined linear velocity which establishes two or more record zones in the radial direction of said record medium, and is different for every zone, It is characterized by having a regenerative-signal evaluation means to reproduce the recorded portion in the last zone and to evaluate a regenerative signal, and a recording condition correction means to amend the recording condition of a new zone based on the evaluation result by said regenerative-signal evaluation means. In order to amend the recording condition of a new zone based on the evaluation result of a regenerative-signal evaluation means according to invention according to claim 1, Maintaining the feature which can do high-speed writing though it is the low rotation of ZCLV, with the film property variation of a record medium, the variation by a radius, the variation of a recording device, etc., even when a recording condition is less the optimal, a recording condition is amended and good recording quality is acquired. Moreover, in order to reproduce the already recorded place at the time of a zone change and to carry out a corrective action, there is no new recording interruption and the time loss in connection with a corrective action decreases.

[0008] Invention according to claim 2 is set to Information Storage Division equipment according to claim 1. A trial writing means to perform trial writing to the predetermined field of said record medium at a predetermined basal line speed, and to determine the optimal recording condition at said basal line speed as it, and when recording on said record medium with a different linear velocity from said basal line speed, Have a recording condition setting means to set up a recording condition according to the result of having performed the predetermined operation to the optimal recording condition at said basal line speed, and [said recording condition correction means] It is characterized by amending the recording condition of the new zone which said recording condition setting means set up based on the evaluation result of said regenerative-signal evaluation means. Since the recording condition correction means amended the recording condition of the new zone set up by the recording condition setting means based on the evaluation result of a regenerative-signal evaluation means according to invention according to claim 2 An initial recording condition can be more correctly determined from a trial writing result, and better recording quality can be acquired.

[0009] invention according to claim 3 -- the circumferencial direction of a disk-like record medium -- abbreviation -- [fixed linear density / it is Information Storage Division equipment which writes in information, and] The zone CLV writing control means which writes in with a predetermined linear velocity which establishes two or more record zones in the radial direction of said record medium, and is different for every zone, After changing said record zone, it is characterized by having a regenerative-signal evaluation means to reproduce the recorded portion in a new zone and to evaluate a regenerative signal, and a recording condition correction means to amend the recording condition of a new zone based on the

evaluation result by said regenerative-signal evaluation means. In order to amend the recording condition of a new zone based on the evaluation result of a regenerative-signal evaluation means according to invention according to claim 3, Maintaining the feature which can do high-speed writing, though it is the low rotation of ZCLV, with the variation by the film property variation and the radius of a record medium, the variation of a recording device, etc., even when a recording condition is less the optimal, a recording condition is amended, and good recording quality is acquired. Moreover, since the recorded section of a new zone itself is reproduced and a corrective action is carried out, correction precision is high.

[0010] Invention according to claim 4 is set to Information Storage Division equipment according to claim 3. A trial writing means to perform trial writing to the predetermined field of said record medium at a predetermined basal line speed, and to determine the optimal recording condition at said basal line speed as it, and when recording on said record medium with a different linear velocity from said basal line speed, Have a recording condition setting means to set up a recording condition according to the result of having performed the predetermined operation to the optimal recording condition at said basal line speed, and [said recording condition correction means] It is characterized by amending the recording condition of the new zone which said recording condition setting means set up based on the evaluation result of said regenerative-signal evaluation means. In order that the recording condition correction means might amend the recording condition of the new zone set up by the recording condition setting means based on the evaluation result of a regenerative-signal evaluation means according to invention according to claim 4, an initial recording condition can be more correctly determined from a trial writing result, and better recording quality is acquired.

[0011] Invention according to claim 5 is set from Claim 1 to Information Storage Division equipment given in any 1 clause of 4. A recorded state storage means to memorize the value according to the regenerative signal from said record medium when beginning record to said record medium as recorded state desired value based on the recording condition which said recording condition correction means amended, While recording information on said record medium, said recorded state desired value is compared with the value according to the regenerative signal from said record medium, and it is characterized by having a record power correction means to correct record power according to the comparison result concerned. While recording information on the record medium according to invention according to claim 5, in order for a record power correction means to compare recorded state desired value with the value according to the regenerative signal from said medium and to correct record power to it according to a comparison result, Record can be continued with the recorded state at the time of initial correction maintained, and still more nearly quality record can be performed. Moreover, since record is not interrupted for this correction, there is no new time loss.

[0012] In the Information Storage Division equipment of a description, invention according to

claim 6 in any 1 clause of 5 from Claim 1 [said regenerative-signal evaluation means] Whenever predetermined conditions are satisfied, record is interrupted, a discontinuation preceding-record finishing portion is reproduced, a regenerative signal is evaluated, and said recording condition correction means is characterized by amending a recording condition based on the evaluation result of said regenerative-signal evaluation means, and resuming record. Since according to invention according to claim 6 a recording condition correction means amends a recording condition and resumed record based on the evaluation result of a regenerative-signal evaluation means, recording condition correction can always be made by actually recorded regenerative-signal evaluation, and still more nearly quality record is attained.

[0013]

[Mode for carrying out the invention] Drawing 1 is the block diagram showing one embodiment of the Information Storage Division equipment in this invention. As shown in a figure, [the Information Storage Division equipment of this invention] With the microcomputer which consists of CPU, ROM, RAM, input/output port, etc. and various mechanisms, and passive circuit elements, are the CD-R drive controlled and specifically [here] It shall be shown by the functional block diagram and information shall be recorded on the circumferencial direction of the optical disk 102 with the linear density of abbreviation regularity.

[0014] The optical disks 102, such as CD-R which is a disk-like record medium, are rotated with the rotary motor 100. On the record film of the optical disk 102, a head 103 makes a light beam condense and forms a recording mark. Moreover, it is movable to the radial direction of the optical disk 102, and accessible to the trial writing field beforehand established in the optical disk 102, and a user data area.

[0015] The light source which is not illustrated is carried in the head 103. As the light source, semiconductor laser (LD:Laser Diode) is usually used. Semiconductor laser is modulated by the predetermined record power state P_w by an input pulse wdata signal with the LD driver 104. A recording mark and a space are made on record film in semiconductor laser being modulated between a record power state and a space power state. By reading this, the difference of a reflection factor arises and it can reproduce as an information signal.

[0016] Two or more zones are prepared for every predetermined position, the ZCLV write-in control section 109 controls the rotary motor 100 according to each zone, and the optical disk 102 makes recording speed variable. The example of the zone division to drawing 7 is shown. Here, four zones are prepared according to the address currently recorded on the optical disk 102, and the speed of 12X (12x), 16X (16x), 20X (20x), and 24X (24x) is assigned from inner circumference.

[0017] 106 is the recording condition setting section and holds the record power information according to each zone. Although the value decided beforehand is sufficient as this record

power information, the value more preferably calculated according to the result of having performed trial writing by the trial writing control section 105 is sufficient as it. A flow chart shows the example of operation by the trial writing control section 105 to drawing 3 . Trial writing shall be performed in the predetermined field of the optical disk 102, and changes and records some record power on a predetermined region at Step S301. The field is reproduced at Step S302, and a well-known rate scale value "beta" is acquired from a regenerative signal. "beta" is equivalent to the symmetric property of the up-and-down amplitude when removing the low-pass component of the regenerative signal RF (AC combination).

[0018] The state of the regenerative signal RF by record power is shown in drawing 8 . If it assumes that a reflection factor falls in the recording mark section as a property of the record film of the optical disk 102 and the regenerative signal RF assumes that it becomes low in the low reflective section, as shown in drawing 8 (a), the regenerative signal RF by which AC combination was carried out in the proper recorded state will be symmetrical with the upper and lower sides, and will become RF amplitude $a=b$. Moreover, since the recording mark section becomes long as shown in drawing 8 (b) when record power is excessive, if AC combination is carried out, upper level will become high and will become $a>b$. Furthermore, since the recording mark section becomes short as shown in drawing 8 (c) when record power is insufficient, if AC combination is carried out, bottom level will become high and will become $a<b$. The quantity which normalized the difference of Above a and b with RF amplitude ($a+b$) is a beta value. namely, -- if it is " $\text{beta}=(a-b)/(a+b)$ " and is proper -- "beta" -- almost -- "0" and power -- "beta" becomes small if [if "beta" is large, and].

[0019] Explanation is returned to the flow chart of drawing 3 . It asks for the record power "Pwopc [0]" from which "beta" becomes after measurement at Step S302, and becomes predetermined desired value "betaT" at Step S303 about "beta." Although "betaT" is close to "0", "0" is not the optimal, and since there are some to which a certain value becomes the optimal depending on the record film of the optical disk 102, it is made a value different generally for every kind of optical disk 102. Since this record power "Pwopc [0]" is the optimum power in the linear velocity which carried out trial writing, it asks for the record power in the linear velocity of each zone according to the predetermined operation based on "Pwopc [0]." At Step S304, [the record power "Pwopc [n]" (n is the zone number 1, 2, 3, and ..) of each zone] Record power "Pwopc [0]" is multiplied by a predetermined coefficient "L [n]", and it calculates as " $\text{Pwopc}[n] = \text{Pwopc}[0] * L[n]$ ", and gives the recording condition setting section 106.

[0020] Explanation is returned to drawing 1 . 108 is the regenerative-signal evaluation section, during record, when a zone change arises by the ZCLV write-in control section 109, it reproduces the backmost part of the present zone, measures "beta", and corrects the record power of a new zone by the recording condition correction section 107 according to a

comparison result with desired value "betaT." A flow chart shows the example of a power corrective action by the recording condition correction section 107 when the change to "n+1" from a zone number "n" occurs in drawing 2, the regenerative-signal evaluation section 108, and the ZCLV writing control section 109.

[0021] In drawing 2, first, the backmost part of the present zone "n" is reproduced at Step S201, and beta is measured at Step S202. And only the part which multiplied the comparison result of "beta" and "betaT" by the predetermined coefficient K at Step S203 corrects the initial-setting record power "Pw opc [n+1]" of a zone "n+1", and obtains "Pw [n+1]." If "beta" is smaller than "betaT", specifically, it will correct so that power may be made to increase. In addition, initial-setting power is the value decided beforehand or the value decided by trial writing, is stored in the recording condition setting section 106, and makes record power corrected at Step S204 the record power of the zone "n+1." The regenerative signal recorded immediately before as mentioned above is evaluated, and the record power of the next zone is corrected.

[0022] The flow chart shown in drawing 4 shows the example of the power corrective action by the recording condition correction section 107 when the change to "n+1" from a zone number "n" occurs, the regenerative-signal evaluation section 108, and the ZCLV write-in control section 109. Here, record is first interrupted for Step S401. Record power of a new zone "n+1" is made into initial-setting power "Pw opc [n+1]" at Step S402, and record is resumed in a new zone "n+1" at Step S403. So far, it is the same operation as conventional parallel, and henceforth becomes the power corrective action of this invention.

[0023] That is, 1 sector information is recorded at Step S404, the 1 sector is reproduced by the regenerative-signal evaluation section 108 at Step S405, and the beta is measured at Step S406. And at Step S407, only the part which multiplied the comparison result of "beta" and "betaT" by the predetermined coefficient "K" corrects the record power "Pw [n+1]" of a zone "n+1", and obtains new "Pw [n+1]." If "beta" is smaller than "betaT", specifically, it will correct so that power may be made to increase. By repeating operation of above-mentioned step S404-S407 10 times, record power is corrected so that (Step S408) and "beta" may become equal to "betaT." A coefficient "K" is a coefficient which controls convergence speed, since 1 time of adjustment quantity will become large if large, convergence becomes quick, but if it enlarges not much, it will become sensitive to an error of measurement, and convergence will become slow if not much small.

[0024] In addition, in the flow chart shown in drawing 2, before changing a zone and beginning to write, the record power of a new zone was corrected from reproduction evaluation of the last zone, but in drawing 4, after a zone changes, reproduction evaluation of a new zone is performed and power correction is made. Therefore, since the way shown in drawing 4 is the power by evaluation in the present zone, record power can be corrected more correctly, but

the lost time for the power correction from recording interruption arising comparatively mostly becomes large. Moreover, in drawing 2 , the effect that the lost time for power correction hardly arises is acquired.

[0025] Moreover, after the power corrective action shown in drawing 2 and drawing 4 , in the midst of recording information on a new zone, record is interrupted periodically, the place recorded immediately before can be reproduced, a regenerative signal can be evaluated, and record power can also be corrected according to an evaluation result. In this case, what is necessary is just to perform processing of Step S404 to the step S407 periodically. When not only every predetermined time but a predetermined temperature change occurs, whenever some conditions are satisfied, you may perform starting of operation of power correction like. A thereby still more exact power correction is possible.

[0026] Drawing 5 is the block diagram showing other embodiments of the Information Storage Division equipment in this invention, and the block shown in drawing 1 and the block to which the same number was given presuppose that it is the same as it which shows drawing 1 . Here, further, the recorded state detecting element 110, the record power correction control section 111, and the recorded state desired value storage section 112 are added, thereby, a recorded state is detected in the composition shown in drawing 1 from the regenerative signal under record, and power correction is made on it. The desired value applies the recorded state in the stage which correction of initial power finished after a zone change by operation shown in drawing 2 or drawing 4 . Since it is the almost optimal recorded state immediately after making initial power correction, it makes this desired value. Henceforth, even if a recorded state changes with temperature change, the sensitivity changes of record film, etc., it can amend by detecting a recorded state from the regenerative signal under record, and making power correction. Since this does not interrupt record, time loss does not produce it.

[0027] It is the recorded state detecting element 110, and, specifically, let the value which sampled the regenerative signal under record to predetermined timing, and was normalized by record power be a recorded state detection value (for it to be called B value). This operation is shown in drawing 9 . That is, the place where "LD power" has a high level samples a regenerative signal to predetermined timing (O point) in the meantime by the generating portion of a recording pulse. Furthermore, in order to cancel the difference in the amount level of regenerated light by power level, a division (normalization) is done by record power. as a result -- being set to high level, since its recording mark (it becomes low reflection) formation is not enough if a recorded state detection value (B) is insufficient power -- power -- if , mark formation becomes superfluous and is set to low level.

[0028] On the other hand, a zone change occurs and B level immediately after the resumption of record which initial power correction ended is saved as target B level "BT" in the recorded state desired value storage section 112. The record power correction control section 111

measures B level periodically, and corrects record power according to the comparison result as compared with target B level "BT." A flow chart shows this corrective action to drawing 6 . Initial power correction of a zone "n+1" finishes, and the flow chart shown in drawing 6 is the flow of operation from after resumption of record.

[0029] That is, the present "B value" (namely, B value immediately after resumption of record) is first saved as target B level "BT" at Step S501. And "B value" is periodically measured at Step S503, it is what multiplied this "B value" and comparison result with "BT" by the predetermined coefficient "K2" at Step S504, and record power "Pw [n+1]" is corrected. Since it is insufficient power if "B value" is larger than "BT", specifically, the record power correction control section 111 is controlled to make record power increase. By performing Step S503 and operation of S504 about once at 1 second, for example (Step S502), record power is corrected so that "B value" may always become equal to "BT", i.e., desired value."

[0030]

[Effect of the Invention] [maintaining above the feature which can do high-speed writing though it is the low rotation of ZCLV like explanation according to invention according to claim 1 / the film property variation of a record medium, the variation by a radius, the variation of a recording device, etc.] Even when a recording condition is less the optimal, a recording condition can be amended and good recording quality can be acquired. Moreover, in order to reproduce the already recorded place at the time of a zone change and to carry out a corrective action, there is no new recording interruption and the time loss in connection with a corrective action decreases.

[0031] According to invention according to claim 2, an initial recording condition can be more correctly determined from a trial writing result, and better recording quality can be acquired.

[0032] [maintaining the feature which can do high-speed writing according to invention according to claim 3, though it is the low rotation of ZCLV] With the variation by the film property variation and the radius of a record medium, the variation of a recording device, etc., even when a recording condition is less the optimal, a recording condition can be amended, and good recording quality can be acquired. Moreover, since the recorded section of a new zone itself is reproduced and a corrective action is carried out, correction precision is high.

[0033] According to invention according to claim 4, in order to amend the recording condition of a new zone based on an evaluation result, an initial recording condition can be more correctly determined from a trial writing result, and better recording quality is acquired.

[0034] While recording information on the record medium according to invention according to claim 5, in order to compare recorded state desired value with the value according to the regenerative signal from said medium and to correct record power according to a comparison result, Record can be continued with the recorded state at the time of initial correction maintained, and still more nearly quality record can be performed. Moreover, since record is

not interrupted for this correction, there is no new time loss.

[0035] Since according to invention according to claim 6 a recording condition is amended and record was resumed based on the evaluation result, recording condition correction can always be made by actually recorded regenerative-signal evaluation, and still more nearly quality record is attained.

[Translation done.]

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Notes:

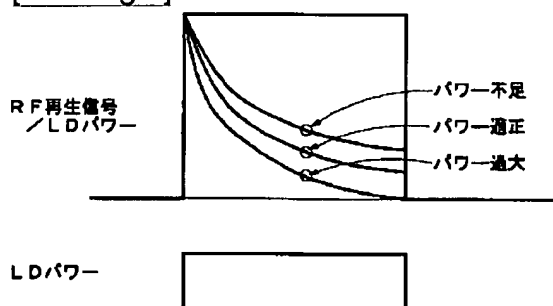
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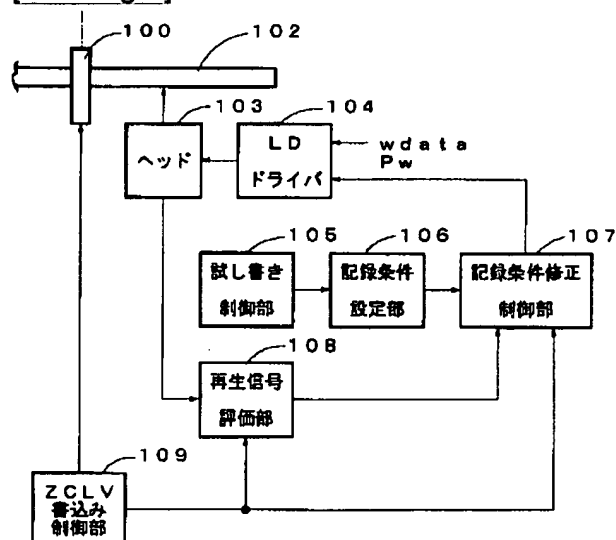
Dictionary: Last updated 08/25/2006 / Priority: 1. Information communication technology (ICT) / 2. Electronic engineering / 3. Industrial Products

DRAWINGS

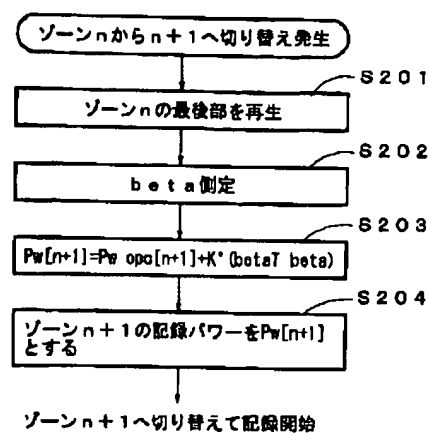
[Drawing 9]



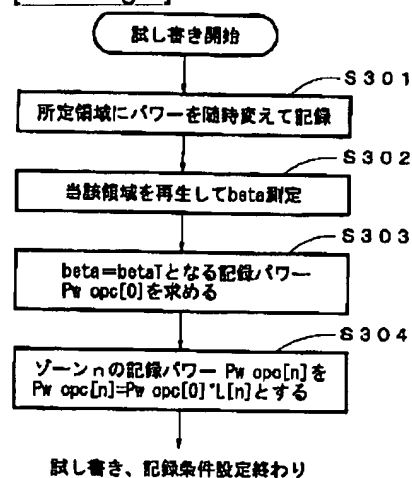
[Drawing 1]



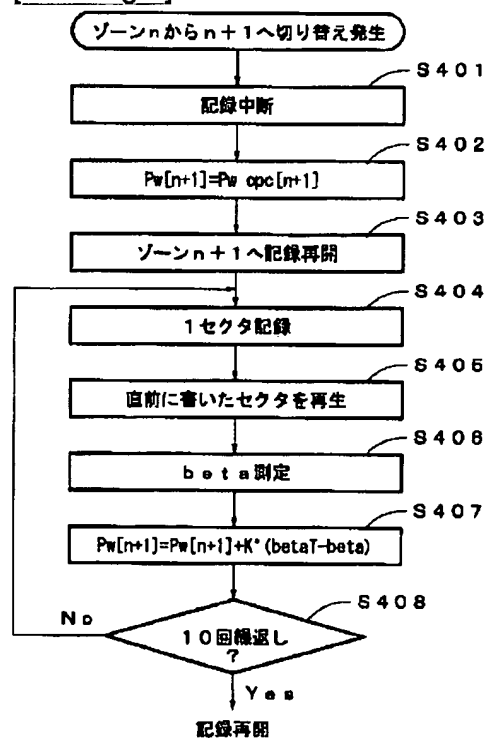
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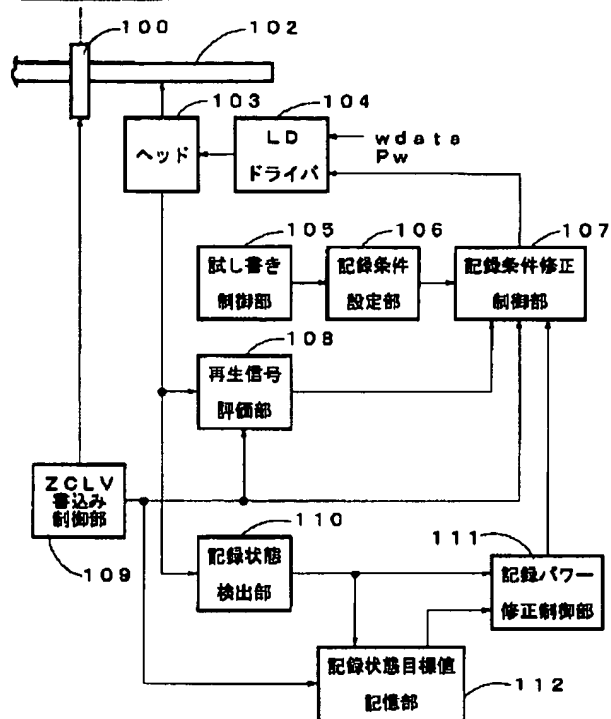
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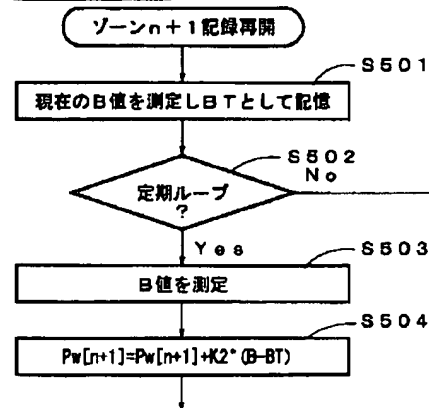
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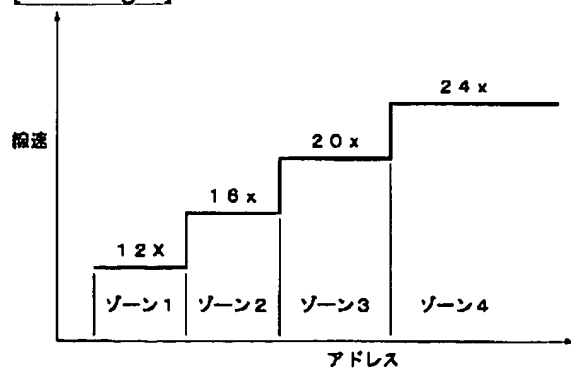
[Drawing 5]



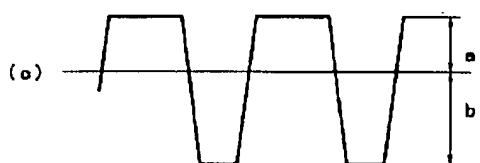
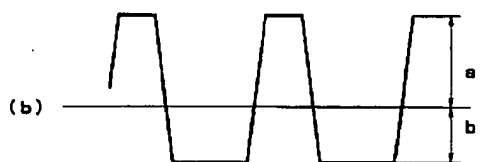
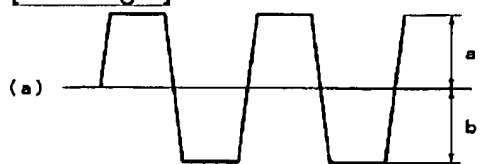
[Drawing 6]



[Drawing 7]



[Drawing 8]



[Translation done.]